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NIXON PEABODY, LLP
401 9TH STREET, NW
SUITE 900
WASINGTON, DC 20004-2128

EXAMINER	
LEE, HSIEN MING	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 01/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/046,893	NAKAMURA ET AL.	
	Examiner	Art Unit	
	Hsien-Ming Lee	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 October 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-22,24-39 and 41-58* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *35-39,41-51,54,57 and 58* is/are allowed.

6)☒ Claim(s) *1,6-20,25-34,52,53 and 55* is/are rejected.

7)☒ Claim(s) *2,3,5,21,22,24 and 56* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Remarks

1. The objection to claims 4,23 and 40 is withdrawn.

2. Applicants' cancellation to claims 4, 23 and 40 is acknowledged.

3. Claims 52-58 are newly added. Thus, claims 1-3, 5-22, 24-39, and 41-58 are pending in the application.

Double Patenting

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 1, 6-20, 25-34, 52-53 and 55 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 10, 12, 14, 16, 17 and 20 of U.S. Patent No. 6,204,101 (Yamazaki et al.) in view of Ueda et al. (US 6,337,259) and Yamazaki et al. (US 6,077,731).

In re claim 1, 6, 11 and 17, Yamazaki et al. (US '101) teach a method of manufacturing a semiconductor device, comprising steps of:

* adding a metal element to a semiconductor film having an amorphous structure, i.e. adding the metal element by comprising the metal element in an amorphous semiconductor film (**claim 14** in Yamazaki '101);

* crystallizing the semiconductor film having an amorphous structure to form a semiconductor film having a crystalline structure, i.e. crystallizing the amorphous semiconductor film to form a crystallized semiconductor film by heating (**claim 17** in Yamazaki '101);

* selectively adding a rare gas element to the semiconductor film having a crystalline structure to form an impurity region, i.e. adding the rare gas (i.e. Ar, He and Ne) to the crystallized semiconductor film by heating the crystallized semiconductor film in an atmosphere comprising at least a material selected from the group consisting of Ar, He and Ne to form the impurity region (i.e. a desired region in the crystallized semiconductor film that is doped with the rare gas by heating the crystallized semiconductor film in the rare gas atmosphere) (**claim 12** in Yamazaki '101); and

* gettering the metal element to the impurity region to selectively remove or reduce the metal element in the semiconductor film having a crystalline structure, i.e. gettering by reducing the metal element in the crystallized semiconductor film by heating (**claim 16** in Yamazaki '101).

Yamazaki et al. (US '101) do not claim the step of removing the impurity region.

However, the removing step is a necessary step prior to proceeding subsequent processing to complete the formation of the semiconductor device, as evidenced by Ueda et al. Ueda et al. in an analogous art teach steps of: (1) adding a metal element (i.e. Fe, Co, Ni, Cu, Ru,

Rh, Pd, Os, Ir, Pt or Au) to an amorphous silicon film 22 by spin coating a nickel-containing film 23 thereon (claim 2 and Fig.1B); (2) crystallizing the amorphous silicon film 22 to form a crystalline silicon film 24 by heating (claim 1); (3) doping impurity into the crystalline silicon film to form an impurity region 27 by a first gettering step (claim3 and Fig.1E) ; (4) gettering the metal element to the impurity region 28 (derived from region 27) to selectively remove or reduce the metal element in the crystalline semiconductor film 24 in second gettering step (claim 1and Fig.1F); and (5) removing the impurity region 28 (Claim 4 and Fig.1G).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to remove the impurity region as taught by Ueda et al. after the gettering step of Yamazaki et al. (US '101), since by doing so it would prevent the metal element from diffusing into the remaining crystalline semiconductor film (i.e. a gettered region, col.14, lines 5-13, Ueda et al.), which would is beneficial to the formation of the semiconductor device as shown in Fig. 1L of Ueda et al.

In re claims 16 and 33, Yamazaki et al. (US '101) claim that the metal element is for the purpose of promoting crystallization of the amorphous semiconductor film but do not claim that the metal element is one kind or plurality of kinds of element selected from the group consisting of Fe, Co, Ru, Rh, Pd, Os, Ir, Pt, Cu and Au.

However, Ueda et al. expressly teach that Fe,Co, Ni, Cu, Ru, Rh, Pd, Os, Ir, Pt and Au are metal elements good for acceleration of the crystallization (claim 2).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to utilize the aforementioned metal elements as taught by Ueda et al. as

the metal element of Yamazaki et al. (US '101), since by this manner it would promote the formation of the crystalline semiconductor film.

In re claims 7, 9, 26 and 28, Yamazaki et al. (US '101) in view of Ueda et al. do not claim and teach that the crystallizing is conducted by irradiation of the semiconductor film having an amorphous structure with strong light; and the crystallizing is conducted by heat treatment and irradiation of the semiconductor film having an amorphous structure with strong light.

However, utilizing irradiation from strong light and heat treatment for crystallizing are well known practice in the art, as evidenced by Yamazaki et al. (US '731), wherein a strong light from a laser is performed for crystallization besides a heat treatment for obtaining high crystallinity (col.38, lines 48-59).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to utilize the strong light such as laser and heat treatment as taught by Yamazaki et al. (US '731) in the method of Yamazaki et al. (US '101) in view of Ueda et al., since by doing so it would achieve high crystallinity in the crystallized semiconductor film (col. 38, lines 56-60, Yamazaki et al. US '731).

In re claims 8, 10, 27 and 31, Yamazaki et al. (US '101) in view of Ueda et al and Yamazaki et al. (US '731) inherently teach that the strong light is emitted from a lamp selected from the group consisting of a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, and a high-pressure mercury lamp. In particular, Yamazaki et al. (US '731) teach utilizing an ultraviolet lamp or an infrared lamp for crystallization (col.39, lines 8-10), wherein the ultraviolet and infrared lamps inherently refer to a halogen arc lamp because the halogen arc lamp produces wide wavelength from infrared rays to ultraviolet rays.

In re claims 12-15, 30, 32, Yamazaki et al. (US '101) in view of Ueda et al. and Yamazaki et al. (US '731) also teach that the gettering is conducted by heat treatment (col.78, lines 17-22, Yamazaki et al. US '731) and irradiation of the semiconductor film with strong light (col.78, lines 8-16,Yamazaki et al. US '731); and the strong light is emitted from ultraviolet or infrared rays, which inherently include the aforementioned halogen lamp (col. 79,lines 34-39, Yamazaki et al. US '731).

In re claims 18-20, 25, 29 and 34, Yamazaki et al. (US '101) teach a method of manufacturing a semiconductor device, comprising steps of:

* adding a metal element to a semiconductor film having an amorphous structure, i.e. adding the metal element by comprising the metal element in an amorphous semiconductor film (**claim 14** in Yamazaki '101);

* crystallizing the semiconductor film having an amorphous structure to form a semiconductor film having a crystalline structure, i.e. crystallizing the amorphous semiconductor film to form a crystallized semiconductor film by heating (**claim 17** in Yamazaki '101);

* selectively adding a rare gas element to the semiconductor film having a crystalline structure to form an impurity region, i.e. adding the rare gas (i.e. Ar, He and Ne) to the crystallized semiconductor film by heating the crystallized semiconductor film in an atmosphere comprising at least a material selected from the group consisting of Ar, He and Ne to form the impurity region (i.e. a desired region in the crystallized semiconductor film that is doped with the rare gas by heating the crystallized semiconductor film in the rare gas atmosphere) (**claim 12** in Yamazaki '101); and

* gettering the metal element to the impurity region to selectively remove or reduce the metal element in the semiconductor film having a crystalline structure, i.e. gettering by reducing the metal element in the crystallized semiconductor film by heating (**claim 16** in Yamazaki '101).

Yamazaki et al. (US '101) do not claim the steps of : (1) forming a first mask on the semiconductor film having a crystalline structure; (2) forming a second mask on the semiconductor film having a crystalline structure; and (3) selectively removing the semiconductor film; (4) that the impurity region and a part of the semiconductor film having a crystalline structure are removed in the selectively removing the semiconductor film; and (5) that the second mask is provided at a position on an inner side of the ends of the first mask.

However, the aforementioned three steps are necessary procedure for forming the semiconductor device, as evidenced by Ueda et al. Ueda et al. teach forming a first mask 16 on the crystalline semiconductor film 14 for the purpose of forming impurity region 17 (Fig.7D-7E); and forming a second mask (not shown) on the crystalline semiconductor film 14 for removing peripheral portion 19 of the semiconductor film 14 (Fig.7F and col. 2, lines 56-62); selectively removing the semiconductor film, i.e. selectively removing the peripheral portion 19 of the semiconductor film 14; the impurity region 17 and a part of the semiconductor film 19 having a crystalline structure are removed in the selectively removing the semiconductor film 14 (Figs 7E-7F); and that the second mask (not shown) is provided at a position on an inner side of the ends of the first mask 16, i.e. the second mask (not shown) is smaller than the first mask 16.

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to utilize the aforementioned steps as taught by Ueda et al. in the method of

Yamazaki et al (US '101), since by this manner it would make an island-shape active region for TFT (col.14, lines 55-58).

In re newly added claims 52 and 53, Yamazaki '101 also claim that said semiconductor device is selected from the group consisting of a liquid crystal device, an EL display device and a thin film integrated circuit (claims 10 and 20), which, to the ordinary skilled in the art, obviously are used in the application of a personal computer.

In re claim 55, Yamazaki et al. (US '101) teach a method of manufacturing a semiconductor device, comprising steps of:

* providing a semiconductor film comprising amorphous silicon with a material for promoting crystallization of silicon, said material comprising a metal element (**claims 12 and 14**);

* crystallizing the semiconductor film by heating the semiconductor film after providing said material for promoting crystallization (**claims 12 and 17**);

* selectively adding a rare gas element to the crystallized semiconductor film, i.e. adding the rare gas (i.e. Ar, He and Ne) to the crystallized semiconductor film by heating the crystallized semiconductor film in an atmosphere comprising at least a material selected from the group consisting of Ar, He and Ne to form a selected region (i.e. a desired region in the crystallized semiconductor film that is doped with the rare gas by heating the crystallized semiconductor film in the rare gas atmosphere) (**claim 12**); and

* gettering the metal element to the selected region to remove or reduce the metal element in the crystallized semiconductor film, i.e. gettering by reducing the metal element in the crystallized semiconductor film by heating (**claim 16**).

Yamazaki et al. (US '101) do not claim the step of removing the selected region after the gettering.

However, the removing step is a necessary step prior to proceeding subsequent processing to complete the formation of the semiconductor device, as evidenced by Ueda et al. Ueda et al. in an analogous art teach steps of: (1) adding a metal element (i.e. Fe,Co, Ni, Cu, Ru, Rh, Pd, Os, Ir, Pt or Au) to an amorphous silicon film 22 by spin coating a nickel-containing film 23 thereon (claim 2 and Fig.1B); (2) crystallizing the amorphous silicon film 22 to form a crystalline silicon film 24 by heating (claim 1); (3) doping impurity into the crystalline silicon film to form an impurity region 27 by a first gettering step (claim3 and Fig.1E) ; (4) gettering the metal element to the impurity region 28 (derived from region 27) to remove or reduce the metal element in the crystalline semiconductor film 24 in second gettering step (claim 1and Fig.1F); and (5) removing the selected impurity region 28 (Claim 4 and Fig.1G).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to remove the selected impurity region, as taught by Ueda et al., after the gettering step of Yamazaki et al. (US '101), since by doing so it would prevent the metal element from diffusing into the remaining crystallized semiconductor film (i.e. a gettered region, col.14, lines 5-13, Ueda et al.), which would is beneficial to the formation of the semiconductor device as shown in Fig. 1L of Ueda et al.

Allowable Subject Matter

6. Claims 35-39, 41-51, 54, 57 and 58 are allowed.

7. Claims 2, 3, 5, 21, 22, 24 and 56 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter:

Yamazaki '101 does not claim forming a *first mask* on a semiconductor film having an *amorphous* structure for selectively adding the metal element (claim 35); forming a second mask on the semiconductor film having a crystalline structure (claim 35); and adding the rare gas element by ion doping or ion implantation (claims 56 and 58); covering a first portion of the crystallized semiconductor film with a *first mask* (claim 57); covering a selected portion of the first portion of the crystallized semiconductor film with a *second mask after said heating* (claim 57); and the metal element in the *first portion* of the crystallized semiconductor film *moves to the second portion* (claim 57).

Yamazaki '731 does not claim forming a *first mask* on a semiconductor film having an *amorphous* structure for selectively adding the metal element. Instead, the way that the metal element is added into the semiconductor film in Yamazaki et al. (US '731) is not *selectively added* by forming the *first mask* but by spin-coating.

Yamazaki '101 does not claim that one kind or a plurality of kinds of elements selected from the group consisting of *H, H2, O, O2, and P are added in addition to the rare gas* element claims 2, 21); that the selectively adding a rare gas element is conducted in an atmosphere containing a *rare gas element and water vapor* (claims 3, 22); and oxidizing a surface of the semiconductor film having a crystalline structure with *a solution containing ozone after the crystallizing* (claims 5, 24).

Response to Arguments

9. Applicant's arguments filed 10/23/03 have been fully considered but they are not persuasive.

Regarding double patenting rejection to claims 1, 4, 6-20, 23 and 25-34, applicants argued that "independent claims 1, 18 and 35 of the present invention are patentably distinct from the claims of Yamazaki '101, either alone or in combination with Ueda and Yamazaki '731" (lines 4-6, page 13) because " Yamazaki '101 do not recite adding a rare gas element to the semiconductor film" (lines 17-18,page 13).

In response to the argument, although Yamazaki '101 do not literally recite "adding a rare gas element to the semiconductor film having a crystalline structure", Yamazaki '101 in claim 12 **do** recite "heating said **crystallized** semiconductor film .... in an atmosphere comprising of **Ar**, N_2, **He and Ne**." (Emphasis added) The adding step is **performed by heating** the crystallized semiconductor film in the **rare gas** ambient (i.e. Ar, He and Ne). Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to recognize that Yamazaki '101 do claim the aforementioned limitation, regardless of the obvious variation in claim language.

As far as independent claim 35 is concerned, the Examiner does agree that it is patentably distinct from the claims of Yamazaki '101. However, claim 35 is **not** rejected under double patenting, as applicants asserted. In fact, the Examiner already indicated that claim 35 is allowable, as set forth in the previous Office Action.

Applicants further argued that "Ueda and Yamazaki '731 do not cure the deficiencies in Yamazaki '101" (third paragraph, page 13) because "Ueda and Yamazaki '731 do not teach or

suggest selectively adding a rare gas element to the semiconductor film having a crystalline structure to form an impurity region" (third paragraph, page 13).

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In this case, Ueda reference is used to remedy the deficiencies that Yamazaki '101 does not claim "removing the impurity region" (in re claim 1 of the instant invention); and "the metal element is one kind or plurality of kinds of element selected from the group consisting of Fe, Co, Ru, Rh, Pd, Os, Ir, Pt, Cu and Au" (in re claims 16 and 33 of the instant invention). With the combined teachings of Yamazaki '101 and Ueda, it would prevent undesirable metal element from diffusing into the remaining crystalline semiconductor film and promote the formation of the crystalline semiconductor film, as indicated previously.

In addition, Yamazaki '731 is used to remedy the deficiencies that Yamazaki '101 in view of Ueda do not teach "the crystallizing is conducted by irradiation of the semiconductor film having an amorphous structure with strong light" (in re claims 7 and 26 of the instant invention); and "the crystallizing is conducted by heat treatment and irradiation of the semiconductor film having an amorphous structure with strong light" (in re claims 9 and 28 of the instant invention). With the combined teachings of Yamazaki '101, Ueda and Yamazaki '731, it would achieve high crystallinity in the crystallized semiconductor film, as indicated previously.

For the reasons above, the double patenting rejection is deemed proper.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Hsien-Ming Lee
Examiner
Art Unit 2823

Dec 31, 2003